The Journal

OF THE AMERICAN SOCIETY OF SAFETY ENGINEERS

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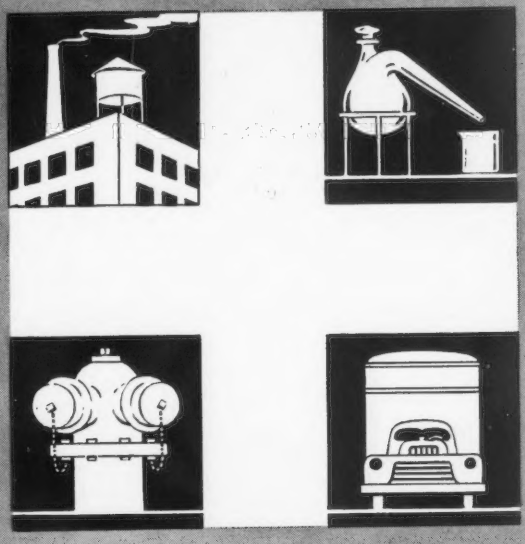

FEBRUARY, 1961
Volume VI Number 1

Journal Presents 3 Winners Of Technical Paper Awards

■ IN THIS ISSUE, the *Journal* is proud to present three of the five Technical Paper Award winners for 1960. Winners of the second presentation of these awards, co-sponsored by the Veterans of Safety and the American Society of Safety Engineers, were announced October 18, 1960 at the Society's Awards Luncheon in Chicago.

On page 2 is the first place winner – "The Personal Touch" by Robert D. Gidel, an article written in the now famous "gone" style created by its author.

The next two articles are "Safety – Its Relation to Cost and Production" by Albert L. Anthony, and "How Much Safety Factor?" by Robert F. Schoof, both winners of Honorable Mention.

Mr. Anthony's article focuses attention on both the direct and indirect costs of accidents, with detailed scrutiny of the so-called hidden costs as related to production. Mr. Schoof's article deals with the technical problems of engineering design as they are affected by established standards, efficiency and safety factors.

■ The influence of the *Journal* and the far reaches of the earth to which this influence spreads is never better illustrated than this case which came to our attention recently. In the July, 1960 issue of *Safety Engineering*, published by the Safety Engineering Society of Australia, an article which originally appeared in the *Journal* – "The Most Misunderstood Subject in Accident Prevention" by Merrill C. M. Pollard – was reprinted in its entirety for the benefit of the safety engineer "down under." – *the Editor.*

AMERICAN SOCIETY OF SAFETY ENGINEERS

Organized 1911 – Chartered 1915

5 North Wabash Avenue, Chicago 2, Ill.

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OUR PRESIDENT SPEAKS ON SAFETY

IT WAS MY PLEASURE recently to present a charter to the 76th Chapter of the Society, the Mississippi Chapter. The occasion was a most enjoyable one, and I left Jackson, Mississippi, with a warm regard for the famed southern hospitality which was so generously shown.

In presenting the charter to the Mississippi Chapter, I briefly outlined the growth of the Society from 35 members in 1911 to 7,300 in 1960. Our rate of growth up to 1947, when we became an independent organization, averaged about 100 members per year and our membership totaled 3,900. From 1947 to 1960, our increase in membership averaged 270 per year, although the growth annually tapered off in the latter years until we actually showed a decrease in membership of 40 in the year from September 30, 1959, to September 30, 1960.

Does this leveling off and reversal in growth mean that we have "topped out?" Have we reached the saturation point? Do we now have in the Society all of the qualified people in safety? Our temporary stall may be a repercussion of the Society's dues increase or a reflection of business conditions or a combination of both. Our long-range outlook, however, must be good, since industry's continual expansion constantly creates positions for safety engineers.

One of the reasons convincing me that our Society has not reached a saturation point where we can feel that most all of the qualified safety engineers are members, is the experience of the Greater Chicago Chapter with a membership drive it conducted three years ago. By a well-organized, concerted campaign, this chapter increased its membership by approximately 100, or a 33 per cent rise in one year. If you wish complete details on this campaign, our Managing Director, Al Blackman, will be happy to furnish them.

The Greater Chicago Chapter's success with their membership drive is significant. It would indicate that there are a great many people in safety who could be encouraged to become members of our Society if an effort was made to acquaint them with the objectives of the Society and the benefits of membership in it.

What has your chapter done about trying to increase its membership? Has it promoted a membership drive? Has it developed a list of all of the potential members in its area? There are a number of sources available to assist in creating such a list.

Chapter members engaged in selling safety protective equipment, for example, could provide a fairly complete list of safety engineers in a chapter area from their customer contacts. Local safety councils, chambers of commerce, state industry associations are also good sources of prospective members.

Once you have completed a list, a plan of action should be decided upon to interest non-members in the Society. This could be done by mail, telephone, friends or a Society guest night meeting. The national office has brochure material available which outlines the Society's objectives and a set of slides describing A.S.S.E. activities.

There is no reason why our Society should not show a steady growth. The Committee on Membership is responsible for the investigation and development of means to increase membership, but the problem is essentially one which must be solved at the "grass roots" level – the chapters.

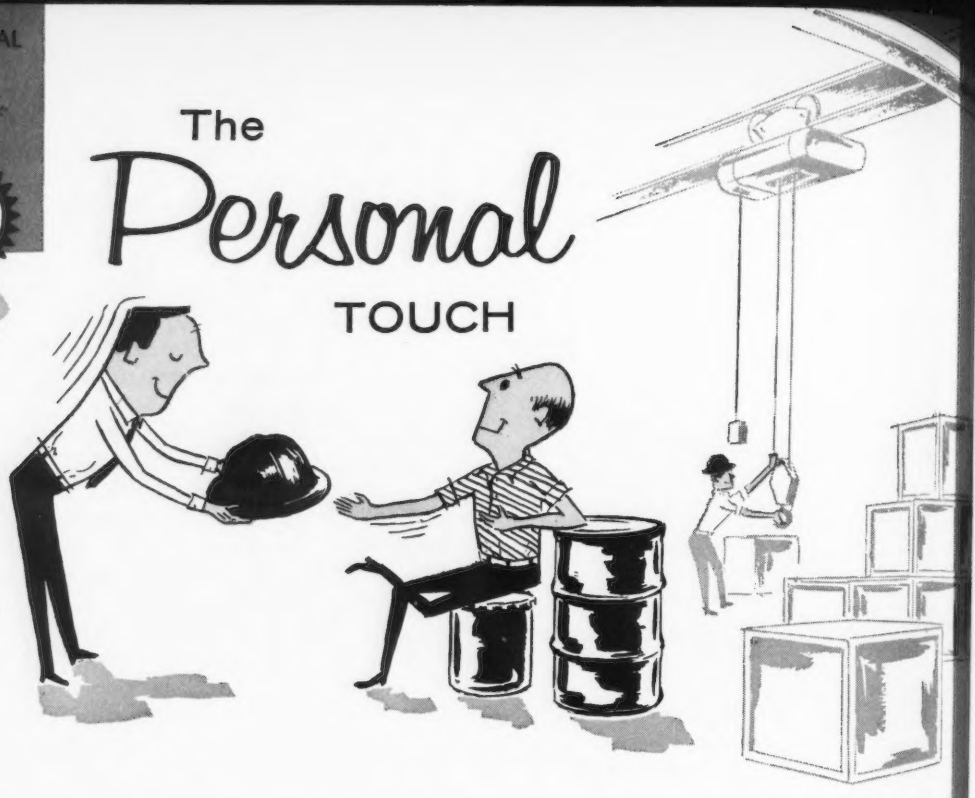
George L. Gorbell

GEORGE L. GORBELL, PRESIDENT
AMERICAN SOCIETY OF SAFETY ENGINEERS

TECHNICAL PAPER ANNUAL AWARD

1st prize

The Personal TOUCH



BY ROBERT D. GIDEL

ALTHOUGH MANY safety administrators, consultants and engineers think the foundation of their continued existence rests on their abilities to deal with technical matters, none of them are really cutting the mustard up to expectation unless they use "The Personal Touch." That is, "The Personal Touch" as it relates to every direction they turn in their business and professional lives.

At first blush, this may sound like a pat phrase or slogan drafted from the Madison Ave. garbage heap. Come again please, and let's go in the back door and really see how the situation stacks up inside.

Our problem these days isn't that we don't know how to prevent accidents. We have the technical know-how, the recording procedures, the investigative systems, the training techniques and the supervisory skills. We have the means for providing mechanical safeguards and all sorts of personal protective equipment and devices. We have ways of determining the toxic limits for hazardous materials and we know how to set up controls to cover most any situation. What we don't know, or prac tice, is the way to *personalize* the skills, knowledge and resources we have to the job of preventing accidents.

The skill of personalizing is an absolute necessity if we expect to ride herd on the changes and advances of our dynamic society and keep pace with our competitors. We must compete for men's minds and reason, and we must personalize our pitch in order to attract our share of his attention which is diluted by other personal interests such as high taxes, poisoned cranberries, unruly kids, traffic snarls, payola, the high cost of living and possibly a mother-in-law.

We must personalize to what's bothering man currently, or else it's like making love to a woman in a dead faint. There's just no response.

We have at least three basic personalizing problems to lick if we expect to stay out of the unemployment insurance lineup:

1. How can we personalize ourselves to the times?
2. How can we compete with diversionary elements personalizing safety to the individual?
3. How can we personalize safety to management and convince it that safety is not merely a luxury which can be afforded in a boom but can be forgotten when things slow down?

There are eight areas of personalization for us to consider if we are really to be successful in our job.

Robert D. Gidel is assistant director for safety of the Bureau of Labor Standards, U.S. Department of Labor. He holds a B.S. degree in industrial engineering from Washington University and a bachelor of laws degree from John Marshall Law School. He joined our Society in 1952 and this is his first article to appear in the *Journal*.

They can be considered in the aggregate as constituting our necessary sphere of personal give and take.

We must:

- Personalize to the Times
- Personalize to the Boss
- Personalize to the Employee
- Personalize to the Job
- Personalize to the Family
- Personalize to the Community
- Personalize to the Union
- Personalize to our own Responsibilities

THE TIMES

Ours is a dynamic age. Changes in thinking, techniques and technology are constant and fluid. There is no place in the scheme of things for the inflexible stick-in-the-mud. Our terminology, our topics of conversation, our interests, our objectives, our ways and means of achieving goals vary by the week. Sometimes, and in some areas, by the hour.

If we expect to deal with the people who make up this nervous sea of progress and civilization we must constantly be at the lip of the tide in order to seek out and evaluate. There is no quarter for those steeped in the philosophy of yesterday, or why we used to do it that-a-way.

There are strong forces running, and it is up to us to appraise and harness those which can help us. By the same token we must close the door on misguided, misconceived action which will do harm. We can't throttle progress because it may be dangerous, but we can help channel it into control paths.

Some ways to personalize to the times include:

- Keep abreast of the philosophies, fears, hopes, tempos, and cathartics currently circulating.
- Consider how points can be made by harnessing or yoking them. A point a day may keep the devil away from someone.
- Keep in touch with new methods and materials which might be put into action and create new hazards and problems for your own boys. Don't wait till they're all set up.
- Keep your mind and methods open. Flush regularly.
- Participate in planning and programming new projects in or outside the company.

THE BOSS

If we are to convince production-minded, cost-conscious management that we are more than ersatz professionals we must display at least a working knowledge of modern production techniques and principles of management. These include a working knowledge of:

1. Human psychology
2. Personnel selection and placement
3. Job and methods analysis
4. Supervisory skills
5. Training techniques
6. Scheduling and planning
7. Quality control
8. Cost analysis
9. The physical sciences
10. Inspection and evaluation
11. Investigative procedures and techniques
12. Records and reports
13. Maintenance schedules and procedures
14. Layout and arrangement
15. Research, design and development
16. Specifications and standards
17. Materials handling methods
18. Process and materials flow

How much do you know about each of these subjects areas? Are you on a working acquaintanceship with them? Should you be? To help the boss appreciate the need for safety activities, do you translate the results of your programs into his language? For some ideas, see *Exhibit A*.

Is it wise to submit frequency and severity figures to the boss? Should he be given a list of things called temporary totals, permanent partials, permanent totals? What do they mean to the boss? Are these just specialties of the trade? Are we just trying to force him into our mold?

I suggest all such data should be compiled, then translated before it goes to him, stating such things as:

- *Down-time* directly connected with accidents amounted to blank hours constituting blank cost.
- *Delays* caused by accidents constituted blank hours costing blank dollars.
- *Scrap* or *Rework* resulting from accidents cost blank dollars.
- *Lost Production Time* due to employees being treated for minor injuries amounted to blank hours costing blank dollars.
- *Hiring and Training* expenses in replacing injured employees amounted to blank dollars.
- *Fill in* the other pertinent cost personalizations for your organization.

These suggestions aren't new. If we want the boss to feel that we are in on the act we must relate to his interests and responsibilities, use the language and terms he appreciates, translate program activities into production improvements and reductions in costs, prepare data in "quick-to-assimilate" form so as not to waste his time, keep him informed and make him the front man.

THE EMPLOYEE

Like the man who had to hit the mule over the head first to get his attention, we have to be current, dynamic and interesting in order to get our share of the modern man's mind. This takes imagination, ingenuity and talent. We must be flexible in our attitudes, and possess the skill of changing pace. Keep 'em off balance so they can't get in a rut. We have to:

- Relate to interests, hopes, desires, pocketbooks
- Tie in with current events, local problems and current activities
- Change the pace periodically, inject humor
- Consider local loyalties and prejudices
- Relate to philosophy, environment and background of the work force
- Work in incentives, personal recognition
- Publicize

THE JOB

We can't make a job safe unless we know what duties and elements make up the job. We can't select, place, or train a safe worker for a job unless we know the skills, knowledges and physical requirements for it. To personalize safety to the job we must:

- Prepare a step by step analysis of each job element
- Draw up qualification requirements for each job to guide selection and placement of personnel
- Compile injury data to pinpoint problem jobs
- Analyze layout, flow and methods
- Provide physical and mechanical controls
- Provide chemical and environmental controls

THE UNION

Organized labor is one of the few remaining groups whose potential for supporting safety has not yet been fully utilized. If we expect to make further substantial reductions in the total number of occupational injuries occurring each year, labor must be brought in on the act and required to accept responsibilities to work for the welfare of union members. If we properly personalize our needs to the union, it can supplement our appeals to the employee, as his recognized representative body.

There are several ways to personalize to the union and solicit its cooperation and support.

- Educate union officials on the safety program, its problems, its needs, its technicalities.
- Urge union officials to set up a safety committee within the union – help them program the committee meetings.
- Provide union representation on company safety committees.
- Promote the philosophy of self-discipline, cooperation.
- Promote safety as a conservation service to the members.
- Publicize economics of being injured.

THE FAMILY

The power and influence of the American housewife and Mother should never be underestimated. If we can get Ma on our side, Dad will have some safety supervision at home and while driving with the family on the road. Since Dad is just as absent from the job if he's injured away from it, all the cooperation we can get from the home front should be solicited and welcomed. Ways to personalize to the family include:

- Show family where Dad works – tours of plant
- Arrange family picnics, dinner, parties
- Have family competition for prizes, awards, recognition
- Put Ma on mailing list for all safety publications, campaigns and promotions – particularly holidays, long weekends
- Form women's safety auxiliary
- Compile and publicize data on off-job injuries – distribute causes and corrective measures

THE COMMUNITY

The interests and well being of the work force of any organization are necessarily related to the interests of the community. Since many organizations still do not have full time safety staffs, community safety activities sponsored or supported by those who do can have a beneficial effect on the public not exposed to safety education and supervision on the job. Besides the public and community relations aspects of such activities, the lives you save may be those of some of your most valued employees, who would otherwise be run over or hurt by their neighbors.

Since safety these days is a 24-hour-a-day, 7-day-a-week business, the more you can get other elements in the community talking safety the better control of the odds you'll have.
You can:

- Tie in with local events, holidays, programs
- Form community committees, support them.
- Utilize community specialists for company purposes (firemen, police, other specialists). Form a "Share the Safety Wealth" campaign.
- Help arrange first aid, driving, swimming, firearms, and supervisory training.
- Initiate community campaigns, slogans, contests, awards.
- Key programs to inherent hazards of the area – water, hunting, traffic, sports.

YOUR RESPONSIBILITIES

Do you ever sit down a few moments and cogitate on what you represent, what you are responsible for, what your influence is, and what your objectives are? Do you have a dynamic program or a routine one? Are you bored with your job, or do you come to it each morning with a sense of eagerness and a zeal for tackling new and varied matters that are there if you only seek them? If you're a bored, routine type safetyman, Mac, you just ain't trying!

To personalize yourself more to your own job responsibilities you can do a number of things:

- Get off your seat and mix
- Periodically reappraise your goals, objectives, methods
- Continually update technology, techniques – periodically ask yourself, "Can I jump on top of any situation I may be required to handle"
- Compartmentalize your problems by analysis and classification
- Organize statistics and data collection systems to point up problems – don't force problems to fit a system
- Change systems, procedures and pace periodically
- Assign priorities
- Learn to know the work force, the boss, the work environment – map out best strategy and techniques for dealing with each
- Don't blindly adopt other programs, ratios, data and measures as your own – personalize your program to your problems

This treatise is not meant to mean that safety jobs can be turned over lock, stock and barrel to the personality boys, head shrinkers and paper shufflers. Such lots couldn't do a well-rounded safety job any better than a hot shot technician or scientist would do by waving a slip-stick around and quoting formulas and equations. The guy who'll cut the cake and get the piece with the thickest layer of frosting is the one who can play footsy with those 18 items listed previously herein and generate the where-with-all to carry them off. There's no one way to do this, and each to his own, as long as he gets results.

No matter whether you're peddling brassieres to Fiji Islanders or goggles to steel burners, you have to be ready with an answer to, "What's in it for me?"

EXHIBIT A

BENEFITS FROM SAFETY PROGRAM ACTIVITIES

PERSONNEL BENEFITS

1. **SKILLED MANPOWER IS CONSERVED** *(by safety training, reducing injuries)*
2. **A BETTER CLASS OF EMPLOYEES IS ATTRACTED** *(better working conditions, reputation for safety)*
3. **QUALITY OF SUPERVISION IS IMPROVED** *(considers all production hindrances, safety training)*
4. **TURNOVER AND ABSENTEEISM IS REDUCED** *(better morale, attitudes, improved working conditions, training, fewer accidents)*
5. **EMPLOYEE SKILLS ARE BETTER UTILIZED** *(jobs analyzed for safety and efficiency, training, preplacement testing)*
6. **NEW EMPLOYEES REACH PEAK EFFICIENCY SOONER** *(better training, better supervision, job studies)*
7. **OVERALL MORALE IS IMPROVED** *(better environment, better employee relations, better supervision, develops cooperative spirit)*
8. **LABOR-MANAGEMENT RELATIONS ARE IMPROVED** *(fewer grievances, better cooperation, workers better educated and indoctrinated)*

PRODUCTION BENEFITS

1. **DOWN-TIME OF PRODUCTION MACHINERY IS REDUCED** *(fewer injured operators, better trained operators, better maintenance)*
2. **SET-UP TIME IS REDUCED** *(better trained, job methods are analyzed)*
3. **STIMULATES SUGGESTIONS FOR MORE EFFICIENT OPERATIONS** *(inspection activities, investigation of injuries, safety committee review)*
4. **SAVINGS ON MATERIALS** *(less damaged in accidents, ventilation collection, selection of least hazardous, consider best and safest processing methods)*
5. **PRODUCTION PLANNING AND SCHEDULING IS IMPROVED** *(fewer production workers absent due to injuries, studies for best and safest methods, methods of handling, flow of materials, limits bottlenecks)*
6. **MAINTENANCE COSTS ARE REDUCED** *(regular inspections, better training of operators, better selection of tools and equipment)*
7. **HANDLING OF MATERIALS IS SIMPLIFIED** *(find best and safest way, flow studies, mechanization)*
8. **SCRAP IS REDUCED** *(better trained workers, tools, equipment and methods better selected, improved handling)*
9. **PHYSICAL PLANT IS CONSERVED** *(regular inspections, study maintenance schedules, and methods)*
10. **PUBLIC AND COMMUNITY RELATIONS ARE IMPROVED** *(employees spread word of good workplace, families participate in activities in and out of plant)*
11. **CUSTOMER GOODWILL IS PROMOTED** *(prompt job completon, reliable quality, dependable service)*
12. **QUALITY CONTROL IS IMPROVED** *(better trained workers, more interest, better cooperaton, using best methods and tools)*
13. **PRODUCTIVE TIME LOST DUE TO OFF-THE-JOB ACCIDENTS IS REDUCED** *(safety training on the job carries over, aids community programs)*
14. **PRODUCTIVE EFFECTIVENESS OF SUPERVISION AND WORK FORCE IS IMPROVED** *(training, better class workers, better working conditions, increased cooperation)*
15. **PRODUCTION IS INCREASED BY REMOVING FEAR FACTOR** *(guards, controls, protective clothing)*
16. **LESS CHANCE FOR CATASTROPHES** *(better inspection, maintenance, using less hazardous materials or processes)*

TECHNICAL PAPER ANNUAL AWARD

Honorable Mention

Safety

—its relation to cost and production

by ALBERT L. ANTHONY

IT IS GENERALLY recognized that safety has an effect on the cost of an industrial operation. Yet many persons, even in the safety profession are not truly aware of the far reaching effect it has. It is a subject which needs more advertising, if you will.

Recently, I had an opportunity to hear a debate on whether salesmanship was the most important requisite in the profession of safety, or not. As is the case with most debates, the only conclusion drawn was what remained in the minds of the audience, so there was no simple answer to the question. It was unanimously agreed, however, that without salesmanship, the best safety program, or the best safety solution to any given problem, might never be accepted.

My object here is to assemble some material to demonstrate that a definite relationship exists between safety, cost, and production. This material can then be used in developing advertising and sales approaches to convince others of what we already know.

The other day a friend was telling me of some experiences his son had during acceptance tests and interviews for entrance at a State Teachers College.

A question on the application form asked: *Mother's occupation.* One of the boys thought to himself, "My mother sews," so he filled in the question: "Sewer." Later, when he was being interviewed, the teacher reached this part, and looked up at the boy, saying: "Your mother works in a sewer?"

Another of the boys whose name was Jimmy Kubaczyk went to the interviewer's desk when it was his turn, and gave the teacher his application. The teacher looked at it, and then said: "How do you pronounce your name?" Jimmy immediately replied: "James."

It is obvious that there was a lack of communication here; but also, if you put yourself in the boys' positions, there was considerable nervous tension. This tension was occasioned by a new experience, and a strong desire to make good.

Some form of this nervous tension, coupled with a desire to make good affects all of us in everything we do. And each of us can recall an experience in our lives where we have misunderstood a seemingly simple question, or in turn have been misunderstood.

Thinking back to those days when we were about to graduate from school and face life as an adult for the first time, it is not difficult to recall the feelings of confusion and uncertainty which existed.

In developing our subject, we want to avoid any confusion in arriving at a conclusion. To do this, we shall start with the fundamental concept of "Who Pays for the Cost of an Accident."

There are two costs involved in any personal injury accident – the direct cost, and the indirect cost. The direct cost is also known as the "insured" cost. For our purposes, this can be considered as the amount of money paid to injured employees for workmen's compensation benefits as established by State law, plus the cost of medical treatment.

The indirect cost, which can also be called the "uninsured" cost, may be, and usually is greater than the direct cost. It is "hidden" or "incidental" and thus indirect, because much of it cannot be easily determined in dollars and cents.

Many years ago a study was made which revealed that on national averages, the indirect costs are four times greater than the direct costs. In re-

Albert L. Anthony, service representative for the Loss Prevention Dept., Liberty Mutual Insurance Co., has been a Society member since 1951. He is currently general chairman of the New Jersey Chapter. Mr. Anthony has been with Liberty Mutual for more than 10 years and holds a BS degree from Brown University. This is his first paper published in the Journal.

cent years, there have been articles in trade journals which indicate that this four times factor may no longer be true. They indicate that in most cases, this figure is conservative.

Safety men who have made studies of their operations have stated that this factor is now between seven and fourteen times greater than the direct costs. This becomes a very significant cost of operation, and one which can easily be overlooked unless safety accepts its responsibility to make it recognized.

What are these indirect costs? They include many things such as:

1. *Production Time Lost by an Injured Employee:* This can cover wages paid him for time spent in getting first aid; for time not worked that day if he does not return to work; for poor quality or less work when he does return to work.
2. *Time Lost by Supervisors:* The time spent in seeing that the injured employee is taken care of; in investigating the circumstances of the accident; in rearranging the production schedule; in making a report of the accident.
3. *Time Lost in Repairing, Replacing, Clearing Away, Rearranging or Cleaning Up* equipment or material that was damaged or disarranged by the accident.
4. *Production Time and Product Lost* if a machine is shut down or a continuous process halted.
5. *Production Time and Product Lost* by other employees near or at the scene of the accident.
6. *Cost of overtime wages* to make up lost production.
7. *Cost of Material Spoiled or Reprocessing of Product or Material Damaged* by the accident or by a substitute employee.
8. *Cost of Transferring or Hiring and Re-Training or Training of Substitute Employee* in temporarily accepting less quantity and quality of production from him.
9. *Cost of on-the-job First Aid.*
10. *Miscellaneous or Unusual Costs* such as renting of replacement equipment, loss of profit on contracts cancelled, customer good-will on late deliveries, etc.

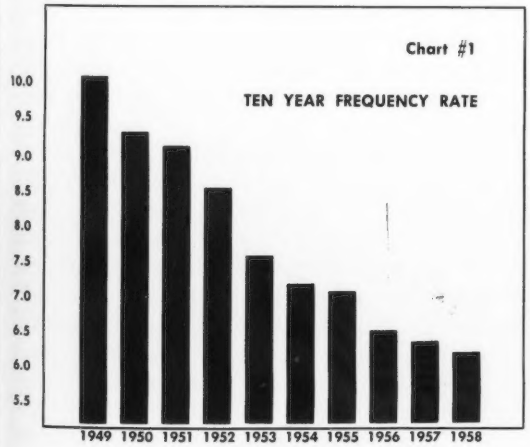
It should now be apparent that the company pays the cost of the accidents, both the direct and indirect costs in the final dollars and cents. Perhaps less apparent, but equally true is the fact that the immediate supervisor also pays the cost. His performance efficiency cannot help but suffer with the added burden of the various factors involved. And the injured man himself pays in the same manner as any accidentally injured person does.

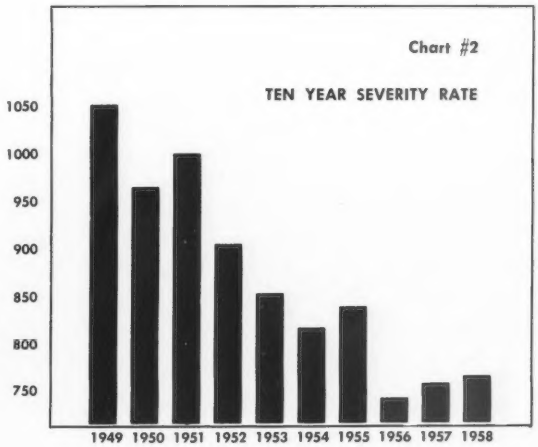
WHO PAYS FOR ACCIDENTS?

There is a fallacy in the minds of many people even today as to who pays for accidents. Each of you has heard the statement: "Oh, it doesn't cost me anything, I'm insured." True, the money allocated to insurance, in the form of premiums, provides the dollars and cents to pay for claims. But these premiums must also pay for administrative expense over and above claim losses. There are also such other things as experience modification factors, base rate development, and expense constants which determine premiums. The end result is that eventually any company, except very small ones, will pay in actual dollars, the full cost of their own experience.

We have now established a common base for understanding where the money comes from to pay for accidents. Now, let us examine some additional background which is important to developing a conclusion about the relation of safety to cost and production.

The American Standards Association Code Z16.1 is the universally accepted method for recording and measuring work injury experience. This has a purpose and answers the need to provide a means of





comparison between companies, locations, industries, or any other grouping desired. Most of us are also aware of the criticisms which have been made of this code in recent years.

During the past year an article was published in the JOURNAL OF THE AMERICAN SOCIETY OF SAFETY ENGINEERS to the effect that the true meaning of frequency and severity data is known mainly to safety people themselves. Perhaps the data means something to us but it has been my own experience that all too often the people to whom these rates are presented do not fully comprehend their meaning. Many times these figures do not correlate with the financial reports.

However, this data is still the accepted yardstick, and offers us a convenient take-off reference point.

10-YEAR FREQUENCY, SEVERITY RATES

On chart #1 is demonstrated a ten year trend of all industry frequency rates.[1] The steady downward trend is quite apparent.

The trend on chart #2 which shows the severity rates[1] for the same period is not as pronounced, but still is essentially downward.

Recognizing the ten years shown on these charts, the period of 1949 to 1958, we are all very much aware that the economic trend during this period had been rising. We are also aware that the various Workmen's Compensation laws during this period have tended to liberalize benefits, and to include a greater scope of conditions than they once covered.

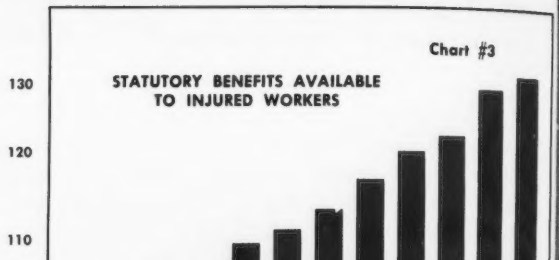
To demonstrate the Compensation benefit trend during the same ten year period, we have taken a weighted nationwide average of benefits available under the Workmen's Compensation acts for the three years 1947 through 1949 as a base point called 100%.

INCREASE IN WORKMEN'S COMPENSATION

Chart #3 shows the percent increase for each of the succeeding years.[2] This demonstrates a significant rising trend and is nearly 29% higher by 1958.

What does this mean to us? Simply that each industrial personal injury which occurs can be expected to have a greater severity today, in terms of economic loss, than the same injury would have had one, two, five, or ten years ago. It also means that the relationship which existed between Compensation benefits and the American Standards Association schedule charges 5 to 10 years ago, no longer holds true.

A comparison of these three charts also reveals another significant fact. During the ten year period



in which the safety movement can take great pride in its accomplishments, according to the accepted standard of measuring performance, an increasingly greater pressure has been affecting the economic results of injuries which still occur.

The next fact is vital to a full recognition of the relationship safety holds to cost and production. Zero or low American Standards Association frequency and severity rates do not mean zero or low economic accident losses to our company. The use of the word accident in this instance would be the definition used in the determination of compensability under a specific Workmen's Compensation Act.

ACHIEVEMENTS WORTHWHILE

It should be made clear that it is not my intent in any way to detract from the various contests run by different agencies, nor from achievements earned in accordance with the ASA code. They are worthwhile, they do serve a purpose, and they remain worthy of all the commendation they receive.

There is a need, however, to recognize the difference between these achievements and the financial results occurring under Workmen's Compensation coverage.

This difference which has been demonstrated between the accepted method for compiling work injury statistics, and the economic results achieved by any particular company, plant, location, or other desired unit for measurement has been gaining recognition in recent years. It is vital to the future role of the safety profession that its full significance be understood.

We have referred to the safety profession, and the title of the subject is *safety*. Many of the individuals practicing the profession are known as safety engi-

neers. None of these titles, however, give any definition of the responsibility. What are the safety engineer's responsibilities?

A review of the safety engineering profession reveals that in its earliest stages, safety engineering was primarily concerned with the correction of physical hazards, with the additional refinement of employee safety training. These are fundamentals which must be continued, making sure they are updated with the advances of industry.

Under these old concepts where the primary function of the safety program was to reduce lost time accidents, the familiar ASA code reflected the job performance.

But is this the only responsibility the profession has? Definitely not! There is a responsibility to prevent loss. As was established earlier, personal injury accidents result in economic loss far out of proportion to the direct cost involved. By the same token, accidents which do not result in personal injury can also cause serious economic loss. This, too, is a part of the problem an effective safety program seeks to control.

On the basis that all injuries cost something even when a single treatment for first aid is all that may be needed, some companies have made use of a frequency rate for total injuries, as distinguished from lost-time cases only.

Chart #4

TOTAL ACCIDENT FREQUENCY

A.S.A. FREQ.	T.A. FREQ.
2.79	1293
2.73	1775
2.65	2106

$$\text{T.A.F.} = \frac{\text{ALL ACCIDENTS REPORTING FOR FIRST AID OR MORE SERIOUS MEDICAL ATTENTION}}{\text{TOTAL MANHOURS WORKED}} \times 1{,}000{,}000$$

On chart #4 the difference between the total accident frequency and the ASA frequency for a three-year period is shown. The values can be seen as 2.79, 2.73, and 2.65 compared to 1293, 1775, and 2106 respectively. At a rate of $3.30 per in-plant medical treatment, they represent from a little over $4,000 per million manhours to slightly less than $7,000 per million manhours worked.

This frequency necessarily includes all those accidents chargeable under the ASA code, and also includes all those incidents previously referred to as occurring during lost-time accident free periods under the ASA code.

Chart #5

COMPENSABLE ACCIDENT FREQUENCY

A.S.A. FREQ.	COMP. FREQ.
2.73	21.43
2.65	20.66

$$\text{COMP. FREQ.} = \frac{\text{ACCIDENTS REPORTED UNDER WORKMAN'S COMPENSATION LAW}}{\text{TOTAL MANHOURS WORKED}} \times 1{,}000{,}000$$

It is true that this system does not reflect the economic results of serious injuries, such as amputations, but it does yield some measure of performance.

Another idea which has been tried with some success has been called Compensable Accident Frequency and Severity. It is patterned on the familiar ASA code, but measures the frequency of all claims reported under the Workmen's Compensation Act, regardless of any concern as to whether they were chargeable accidents under the ASA code or not.

In chart #5 is shown a two-year comparison of the ASA frequency and the Compensable frequency. It will be noted that in this example the Compensable frequency ran about eight times greater than the ASA with rates of 21.43 and 20.66 comparing with 2.73 and 2.65.

The Compensable Severity rate requires a little more calculation. It was determined by applying the indicated percentage of disability provided by medical opinion to the Workmen's Compensation Law schedule and arriving at a number of days. The actual days lost, or this percentage value, whichever was greater, was the number of days charged in the formula. As a matter of interest, the percentage figure usually dominated.

In chart #6 the two-year comparisons of these severity rates are shown. It can be seen that the Compensable Severity rates of 2953 and 2291 compare to ASA rates of 322 and 323.

Although the estimates used to develop these rates were necessarily very "green" or immature in

Chart #6

COMPENSABLE ACCIDENT SEVERITY

A.S.A. SEV.	COMP. SEV.
322	2953
323	2291

$$\text{COMP. SEV.} = \frac{\text{DISABILITY PERCENTAGES PROVIDED BY MEDICAL OPINION IN TERMS OF DAYS, OR ACTUAL DAYS LOST}}{\text{TOTAL MANHOURS WORKED}} \times 1{,}000{,}000$$

order to keep them reasonably current, they still yield a comparative trend picture in terms of anticipated economic results.

The Compensable Accident Frequency and Severity rates would reflect all the various types of injuries reviewed earlier as examples of the economic loss not reflected in the zero ASA rates.

Another idea which provides a tool for keeping currently aware of the economic trend involves using the total value of all compensation claims each month against a manhour base. Again, it is necessary to use very "green" reserve values. By utilizing twelve month moving average rates, some of the bumps can be smoothed out, and a trend line established to show whether experience is improving or becoming poorer.

COMPENSATION RATE INDEX

A formula for this, which has arbitrarily been called a Compensation Rate Index is shown on chart #7. The choice of the manhour base is not of particular significance.

One thousand was selected in this formula as it results in dollar values for the graph. Two thousand might be a good base, as this would yield an approximate cost per employee per year. This would make a good reference point for management in understanding the magnitude of the problem. This method, however, yields only a measure of the economic severity without regard to any frequency.

It has now been developed that all accidents cost money, and that further, the major portion of this money is paid by the company. But where does this money come from? It comes from production since no entity can remain in business unless it produces something for income. In this case even service organizations produce something since they sell their services.

This means that safety has a very vital relationship to cost and production. Now what can safety do about it?

PROVIDE MANAGEMENT WITH LOSS DATA

We have determined that economic loss does not necessarily parallel our accepted method for evaluating safety performance. In matter of fact, it frequently exceeds our yardstick. Thus, it is important that safety assume the responsibility to make certain that management is provided with loss data covering both direct and, at least estimated, indirect costs.

Assuming that this loss data is provided, it should be safety's responsibility to analyze the data, and to make recommendations concerning it.

Chart #7

COMPENSATION RATE INDEX

$$\text{C.R.I.} = \frac{\text{DOLAR VALUE OF ALL COMPENSATION PAYMENTS OR RESERVES}}{\text{TOTAL MANHOURS WORKED}} \times 1{,}000$$

It was indicated earlier that the true meaning of ASA Frequency and Severity Rates is known mainly to safety people themselves, and that the upper echelons of management might be more amenable and appreciative of safety efforts if claim costs were more fully explained. The growing trend towards permanent partial disability awards for non-disabling injuries has watered down the significance of frequency data. Also, the exclusion of many hernia and disability back cases, because the ASA code relating to such cases disqualify them as work injury statistics, has tended to affect the significance of these rates for management.

SAFETY, COST AND PRODUCTION

We have established that a relationship does exist between safety, cost, and production, but there is no simple solution as to what can be done about it. These answers are extremely variable, and must be tailored to the individual needs of each problem. The answer to the following questions should help direct some thinking towards the solutions.

1. Is communication a major problem of safety, as well as production?
2. Is safety training a form of job instruction?
3. Is salesmanship an approach to cooperation?
4. Is hazard elimination a road to improved efficiency?
5. Is loss analysis the start for intelligent corrective control?
6. Do all the tools of safety aid in all phases of management operation?

If the answer to the foregoing questions is "Yes" then should we not ask ourselves, "Can we afford not to make safety a part and parcel of all our production planning operations?"

In summation, all members of the safety profession are well aware of the humanitarian aspects of their job, but they have a further responsibility. This is to recognize and use the language and statistics of top management in preparing and selling programs aimed at controlling economic loss.

REFERENCES

1. National Safety Council *Accident Facts* – 1959 Edition
2. National Council of Compensation Insurance

TECHNICAL PAPER ANNUAL AWARD

Honorable Mention

HOW MUCH SAFETY FACTOR?

Robert F. Schoof, safety engineer for Allis-Chalmers Mfg. Co., holds BS and MS degrees in electrical engineering from the University of Wisconsin. A member of the Society since 1951, he is now secretary of the Milwaukee Chapter. Before joining Allis-Chalmers, he was a safety engineer with the American Insurance Groups. This is his first Journal article.

by ROBERT F. SCHOOF

When fatigue, impact loading and stress concentrations are fully considered, design factors of 5 or 6 may mean actual safety factors of 2 or even less

MANY SAFETY REQUIREMENTS have been established by governmental bodies, standards associations and industry groups to protect the public against injury and loss. In addition to complying with prescribed safety requirements, the designer must provide an acceptable product having a long service life. At the same time, the designer is called upon to make efficient use of materials. The choice of a proper safety factor is, therefore, a serious consideration for the engineer.

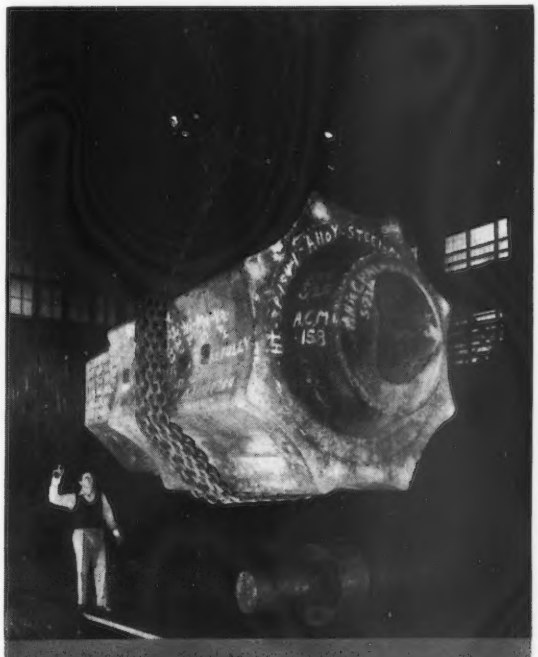
Although based in part on indeterminate factors, this choice can be guided by a number of general design approaches. The first of these approaches considers *equal stress design,* which requires that all parts are utilized at a consistent stress level and stress risers, such as sharp corners and abrupt steps in shafts, are eliminated.

A second general approach, *functional shape,* has been described as a "meditation" upon the shape that a structure would like to take. This design approach has been used to good advantage in such diverse fields as machine tools, bridge designs, modernistic building designs, and in streamlining practices. Although some of the end results may or may not possess esthetic value, these creations generally make efficient use of materials.

When the need is justified, an *individualized comprehensive stress study,* the third approach, is used. While usually costly, an intensive study of the design stresses and stress risers, possibly using strain gauges and photoelastic models, can determine with a good measure of precision the anticipated stress levels.

The designer will generally employ one or more of these approaches in his first analysis of a problem in building a device to perform a particular function. His design philosophy or perhaps the ultimate use or purpose of the device will govern his choice of safety factor. The safety factors required will generally be about equal for equal stress design and for functional shapes. In some cases, a smaller safety factor can be used if an individualized comprehensive stress study is made.

It is extremely important to determine at an early design stage the character of the stresses which could



Ninety tons of alloy steel are gently eased up in this lift in the forge shop. This unusually severe service requires lifting capacity much greater than is needed under normal operating conditions.

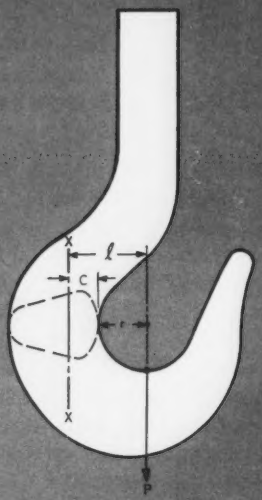
Six-step analysis of safety factors was utilized for the overhead lifting arrangement to remove cover and contactor assembly of the new oil-immersed controller line. Factors considered are loss, load, stress analysis, fabrication, time and economy. (FIGURE 1)

Failure of hitching devices, which can result in personal injury and property damage, is prevented by a study of the safety factors involved. A minimum safety factor of 4-5, with all stress concentrations considered in the analysis, is specified on the ultimate strength of the material

$$S_T = \frac{P}{A} + K\frac{MC}{I}$$

S_T = max. tensile stress, psi.
P = rated capacity, lb.
A_{AA} = area of critical section, sq. in.
K = curved beam stress correction factor
based on ratio $\frac{l}{C}$
M = bending moment, in.-lb.
C = distance from centroid to critical fiber, in.
I = moment of inertia of critical section about the centroidal axis XX, in.^{4}

Min. Factor of Safety = 4.00 on the ultimate strength.
Min. Factor of Safety = 3.00 on the yield strength.



Laboratory tests and analysis of devices designed according to theoretical calculations often result in proving the design sound and, in some cases, can result in lowering the safety factor.

cause failure. Stresses which could render a material unserviceable before the end of the normal life are denoted as damaging stresses. These stresses may be at the yield point, thus causing deformation, or above the fatigue limit, subjecting the device to fatigue failure. Normal and cyclic stresses should be identified clearly. In some cases, because of complex shapes, these stresses may be difficult to determine. Even though test models may be built to resolve geometrical problems, there may be a lack of correlation between the test models or specimens and the finished product. This possible lack of correlation is particularly important when the fatigue limit is the criterion of design.

The fatigue limit applying to the material, obtained either from standards or found by a special test, is still not completely determinate because of variations arising from scale factors, heat-treating differences, and surface finish variations. The fatigue limit selected should therefore be the minimum of the possible values anticipated or suitable allowance should be made in the safety factor.

SIMPLE SIX-PART ANALYSIS

Only after the criterion of damaging stress has been established with reference to the application, and the performance capabilities of the chosen material determined, can safety factors be considered. The actual selection of a factor of safety based on a review of all the various areas of design and ultimate use can be simplified by a six-part analysis. These factors are loss, load, stress analysis, fabrication and assembly, time and economy.

In a normal application, each factor is equal to unity, and a standard factor of safety, based on either ultimate yield or fatigue strength, is used. Special applications could affect each factor within a range of 75 per cent to 200 per cent. Consideration of each factor in relation to the others leads to a decision on the overall factor. Direct multiplication of the six factors is not recommended, since it tends to give unrealistically high values. A high rating of loss factor may include a sufficient allowance for such factors as fabrication and assembly, and time.

1. *Loss Factor* – what are the consequences of failure? Could failure cause loss of life, major property damage, interruption of production or service in a vital plant, or loss of user's good will?
2. *Load factor* – are the loads and therefore the anticipated stresses readily estimated with reasonable tolerance? Known impact or shock loadings which are calculable should be included in stress calculations. Suitable allowance in the safety factor should be made for complex impact

loadings where approximations or estimates of possible loads must be made.

Is there multiple unit operation where loss of function of one unit transfers additional loads to remaining units? In an emergency a unit may often be required to operate up to 150 percent of normal rating.

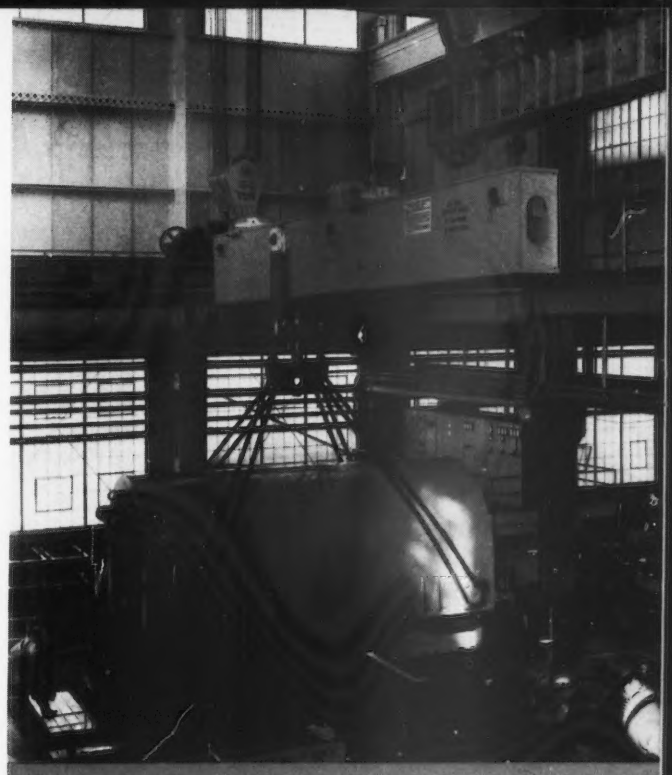
3. *Stress Analysis Factor* – is the stress analysis straightforward and simple or are there stresses involved which, inadequately covered by theory, require approximate methods of calculation? Do vibration and torsional resonance effects warrant investigations? Some spectacular bridge and tower failures have been traced to resonance or vibration effects resulting from wind loads.

4. *Fabrication and Assembly Factor* – Materials frequently change properties while being fabricated. Residual stresses can be produced from forming, bending, punching, hammering and other work. Heat-treating problems, such as inadequate annealing, or welding and plating processes, can produce difficulties. Assembly problems may arise when an unusually high degree of skill is required to obtain maximum performance. By establishing tolerances and inspection requirements, the designer can minimize the chance of error. However, when extensive fabrication or assembly operations on a device introduce changes of indefinite character, an increase over a normal safety factor is required.

5. *Time Factor* – Devices which at the time of construction may be more than suitable for the application may not be adequate in five or ten years. In addition to the effects of wear resulting in misalignment and other difficulties, there are the problems of corrosion, decay, metallurgical changes, brittleness, and creep. Loading changes may also affect some devices. These changes are particularly prevalent in material handling equipment and factory buildings where loadings are constantly increasing. In many cases the device of today may well be expected to do tomorrow's job at least for a time.

6. *Economy Factor* – Three basic considerations in economy are cost of materials, weight requirements and fabricating methods. Where materials are costly and production volume is high, overly generous safety factors are not sound and needed factors should be precisely determined. In aircraft construction, for instance, design for the lightest possible weight consistent with performance and safety requirements is the criterion and is basic for successful economic operation.

This six-step analysis of a specific application can give a definite basis for the selection of a safety factor. Where large production volumes are being contemplated, there is often a desire to reduce a factor of safety and thereby cut initial costs. Any reduction from established norms should be made only with a full understanding of all the factors involved. A major decrease in a previously accepted factor of



Large hydrogen-cooled generator is lifted onto railroad car for shipment. Calculated design stresses for both hook and beam include factors for various fillet radii, curved beams, and holes in plates. Stress levels thus permitted are below the fatigue limit under all except severe impact loads.

safety can rarely be made. However, decreases of 10 to 15 percent are often feasible and safe.

For common designs, experienced designers develop standard stress levels based on accepted safety factors. These factors may be established from a variety of sources.

A new line of oil-immersed controllers presented a problem in safety factors. One version of the device, a ground-supported model shown in *Figure 1*, required an overhead lifting arrangement to remove the cover and contractor assembly from the tank of oil for servicing and inspection. The arrangement consists of removable pipe supports, and I-beam and the actual lifting device. Applying the six selection factors showed that:

1. Loss factor is important because failure of the device could result in severe injury to personnel. An increase over the normal factors is required.
$$F_{Loss} = 1.25$$
2. The load factor is a fixed factor, with the weight (allowing for friction) being definitely established. No impact loading.
$$F_{Load} = 1.0$$
3. Stress analysis is straightforward for eccentric column loading, with no vibration or cyclic loading.
$$F_{Stress} = 1.0$$
4. Fabrication and assembly factor is not a problem. The pipes and I-beam are standard struc-

tural shapes and no processing is involved other than cutting to length.

$$F_{Fab} = 0.90$$

5. Time factor is an important consideration because the device will be exposed to corrosive atmospheres and in service in excess of 10 years.

$$F_{Time} = 1.25$$

6. Economy factor is not affected because aluminum is required for portability of the unit and special efforts to further reduce the weight are not required.

$$F_{Econ} = 1.0$$

The overall factor should therefore be in the range of 1.40 times a normal factor of safety (1.4 X 5.0) or 7.0 on minimum ultimate of 15,000 psi.

The devices were therefore designed using allowable loading of 2150 psi in tension for the aluminum. Calculation using this design stress showed that the pipe supports should be 2 inches in diameter and the aluminum crossbeam a 4-inch I-beam. The lifting device utilized a 5/32-inch cable with a minimum ultimate load rating of 2800 lb. The load being lifted, allowing for possible friction, is under 400 lb. resulting in a minimum safety factor of 7 on the ultimate strength.

MINIMUM SAFETY FACTOR RANGE

Since failure of hitching devices can produce severe personal injury and major property damage, safety factors for this equipment are extremely important. A minimum safety factor range of 4-5 is specified on the ultimate strength. Calculated design stresses include stress concentration factors (K_t) for items such as various fillet radii, curved beams and holes in plates. The stress levels thus permitted are below the fatigue limit under all but severe impact loads.

An alloy steel bar, SAE 4340, used as part of a lift rig, is subject to fatigue failure because of its frequent loading. Since there is also moderate impact loading, a normal safety factor (for non-hitching equipment) could be 2.00 on the fatigue limit.

With reference to the six-factor analysis, the factors for this equipment are as follows:

$F_{Loss} = 1.25$	(Hitching equipment)
$F_{Load} = 1.25\text{-}1.50$	(Moderate impact loading)
$F_{Stress} = 1.00$	(Stress analysis straightforward. Fillet stress concentration factor of 1.5 included in stress calculations.)
$F_{Fab} = 1.25$	(Alloy steel, good quality welding and heat-treatment, rigid inspection)
$F_{Time} = 1.00$	(No moving parts, rating fixed)
$F_{Econ} = 1.00$	(Weight not critical, only one device being built)

The overall factor should therefore be approximately twice the normal factor of 2.00 or 4.00. This is based on true stress levels where stress concentration factors are included. Maximum design stresses would therefore be:

$$\frac{\text{Fatigue strength}}{4.00} = \frac{62{,}500}{4.00} = 15{,}625 \text{ psi}$$

$$\text{True safety factor} = \frac{\text{Damaging stress (\textit{i.e.}, fatigue limit)}}{\text{Maximum known working stress}}$$

$$= \frac{62{,}500}{15{,}625} \times \text{(impact allowance)}$$

$$= \frac{62{,}500\ (1.5)}{15{,}625} = 2.67$$

Use of a safety factor of 5 on the ultimate, without regard to impact and fatigue loadings and stress concentration factors, would result in a true safety factor of 1.26, derived as follows:

$$\frac{110{,}000}{5} = 22{,}000 \text{ psi nominal stress}$$

$$\text{True safety factor} = \frac{\text{Damaging stress}}{\text{Maximum known working stress}}$$

$$= \frac{\text{Fatigue limit}}{\text{Nominal stress (impact load) (stress concentration factors)}}$$

If $K_t = 1.5$

$$\text{True safety factor} = \frac{62{,}500}{22{,}000\ (1.5)\ (1.5)} = 1.26$$

This value is hardly acceptable and emphasizes the need for a complete systematic analysis.

The selection of a safety factor is often governed by accepted standard design stresses or by municipal or state codes. However, many times, particularly on machine parts and devices, the selection of a safety factor is required in the early design stages. By reference and use of the six factors listed, this choice can be made using a comprehensive methodical analysis. True safety factors relating the damaging stress to the actual design stresses can be established, accurately representing the safety level intended by the designer.

REFERENCES

1. "Maximum Stress, Its Influence on Cost and Service Life of a Structure," E. Chapman, *Journal American Welding Society*, Sept. 1931, pp. 19-22.
2. *Metals Engineering Design*, Oscar J. Horger, ASME Handbook, McGraw-Hill Book Company, New York, 1953.
3. *Machinery's Handbook*, E. Oberg and F. D. Jones, Sixteenth Edition, The Industrial Press, 1959, pp. 345, 346, 351.

Abstracts

SAFETY AND RELATED FIELDS

All abstracts being published in the *Journal* are supplied by Engineering Index Inc., Engineering Societies Library, 29 W. 39th St., New York 18, N.Y. Because of space limitations, comparatively few of the abstracts from this service can be published in each *Journal* issue. However, subscriptions to the service are available from Engineering Index Inc., which will send, on request, a free 16 page catalog describing the service. For a nominal charge, Index subscribers may obtain copies of any of the articles which have been abstracted and, also, English translations of those published in foreign languages.

ACCIDENT PREVENTION

Are Standard Procedures Whole Answer, J. R. Howard. *American Petroleum Institute Proceedings,* Vol. 39, Sec. 3 1959, p. 502-6 (discussion) 512-14. Typical Texaco plant organization dealing with unit operations and efforts made to assure steady, safe, and economical operations.

Are We Grounding for Least Possible Hazards?, H. L. Rorden. *Electric Light and Power,* Vol. 38, No. 8 (April 15, 1960), p. 88-90. How, for best overall protection of both linemen and groundmen, working on and around dead transmission line is provided by grounding all three conductors at work area, whether on tower or in substation.

Brooklyn's School of Sewerage Safety, S. Levi. *American City,* Vol. 75 No. 1 (January, 1960), p. 69-71. School is equipped with full scale model sewer, above ground, consisting of 45 ft of 36 in. corrugated steel pipe, brick manhole 8 ft high, with sewer stubs, manhole head, and cover, also gas or smoke chamber 8 x 8 x 8 ft. in size built of fire-retarded wood and floored with concrete; maintenance employees are trained in detection of toxic and explosive gases, in use of protective devices, and in first-aid procedures.

Consider Safety During Engineering and Construction, J. J. Graham. *Petroleum Engineer,* Vol. 32, No. 3 (March, 1960), p. C22, 26-7, 30. Measures Standard Oil Co., Cleveland, Ohio, takes during design and construction to insure that finished plant is adequately safe; steps in chronology of project where safety is of special importance include general engineering specifications, job specifications, engineering flow sheets, plot plan, model review, construction inspection and prestartup operator training.

Do Safety Shoes Really Save? C. F. Burris. *Safety Maintenance,* Vol. 119, No. 2 (February, 1960), p. 11-13. Statistics of survey conducted by National Safety Council over past few years show that toes account for 4% of all accidents; foot injury figures given; large percentage of injuries occurred beyond protective area of toe cap; types of safety footwear discussed; beside industrial workers, it is recommended that safety shoes be worn by farmers, in home work shops and when operating power lawn mowers.

Fire Defense in Depth, W. W. Story. *Safety Maintenance,* Vol. 118, No. 3 (September, 1959), p. 44-6. All types of fire protection and every means of extinguishment are used at Circleville, Ohio plant of E. I. du Pont de Nemours & Co. to combat fire hazards of polymeric materials; weekly training sessions of fire brigades and familiarity with fire extinguishers of all plant personnel are compulsory.

Future of Chemical Safety, A. H. Christian. *Industrial and Engineering Chemistry,* Vol. 52, No. 1 (January, 1960), p. 113A-5A. Future field of chemistry will not be bright unless accident prevention keeps apace and maybe even gets ahead; plant location; process safety; material handling and transportation; fire prevention and fire fighting; mental aspects of safety; personal protective equipment; severity minimization.

How to Cut Baling Wire Hazards. *Safety Maintenance,* Vol. 119, No. 1 (January, 1960), p. 8-10. Haz-

ards given as well as set of rules for cutting steel wire; job requires skill and experience; proper safety equipment and instruction in safe procedure stressed.

New Approach to Safety During Turnarounds, W. A. Ramsay. *Oil and Gas Journal,* Vol. 57, No. 43 (October 19, 1959), p. 110-11. Special safety meeting and resultant safety survey sheet cut lost-time accidents at BP, Ltd's, Kwinana, Australia, refinery; safety record is comparable to that for onstream operation.

Prevention of Electric Shock Hazard as Basic Design Consideration, E. Schechter. *Electrical Manufacturing,* Vol. 65, No. 1 (January, 1960, p. 120-4. Design guide, based on analysis of existing literature, to optimum design procedures for prevention or minimizing of electric shock hazards; curves and nomographs; particular attention to hazard of large exposed non-current-carrying metal parts such as machine frames, also to hazard of exposed parts with sharp edges that tend to break skin.

Safety-Conscious Plant. *Plant Engineering,* Vol. 14, No. 1 (January, 1960), p. 132-3. Gibralter Display Div. of Mead Containers, Inc. has cut accident rate 80% through simple and effective safety program, resulting in heightened plant morale, reduced operating costs, and increased efficiency and production; survey of every accident for past five years enabled analysis of causes, and methods of prevention of future accidents; methods of implementation of safety program described.

Sewage Works Safety, C. E. Keefer. *Water and Sewage Works,* Vol. 107, No. 1 (January, 1960), p. 27-30. Safety measures at Baltimore, Md., sewage works; automatic explosive gas detectors; protected access to facilities; safety of working on streets; statistics of accidents since 1940.

INDUSTRIAL HYGIENE

Abgasreinigung in der Lackdrahtfabrikation, E. C. Betz. *Draht,* Vol. 11, No. 5 (May, 1960), p. 250-2. Waste gas purification in lacquered wire manufacture; general discussion of origin and composition of noxious gases; reasons why dispersion or washing is unsatisfactory; description of different methods and apparatus for purification by oxidation (direct or catalytic combustion).

Ink Mist and How To Control It, V. N. Fedoroff. *Air Engineering,* Vol. 2, No. 2 (February, 1960), p. 21-3, 45. Operation of high speed printing presses creates ink mist problem that fouls presses, and causes toxic and explosive hazard in press rooms; methods of modern ventilation and filtration techniques which have solved problem for printing shops and newspaper press rooms are described.

NOISE CONTROL

Measurement and Abatement of Noise. *Heating and Ventilation Engineering,* Vol. 33, No. 393 (April, 1960), p. 445-52. Nature of noise is defined; scientific basis of its measurement; principles governing noise level reduction in heating and ventilation systems; it is found that high noise levels are injurious to health and even lower levels can affect efficiency of people exposed to them; best method of silencing is to prevent or reduce generation of noise at source.

Ventilation System Noise, H. C. Hardy. National Research Council – Building Research Institute – *Publ. No. 706,* 1959, p. 60-74. Philosophy of approach by which engineers and architects can solve problems of ventilation system noise and write realistic specifications; examples of bad planning; methods of computing sound power ratings and steps necessary in predicting noise performance; tables and graphs illustrate levels and methods.

NUCLEAR SAFETY

Aspects of Control of Radiation Exposure, D. J. Mathias, J. R. A. Lakey. *G.E.C. Atomic Energy Review,* Vol. 2, No. 3 (Spring, 1960), p. 172-6. Hazards of nuclear radiation must be evaluated and minimized during both construction and operation of nuclear power stations; comparatively simple modifications which have been made to standard x-ray machines to enable weld-radiography to be performed safely and conveniently on site are described; types of hazard apt to be encountered during operation of reactor station and general principles for dealing with them.

Safety Principles for Low Power Research Reactors, B. E. Eltham, E. P. Hicks. *Nuclear Engineering,* Vol. 5, No. 46 (March, 1960), p. 96-8. Current interest in low power pool and tank type reactors makes consideration of safety criteria regarding design and location important; restriction of excess reactivity of system, assurance of sufficient cooling in core to avoid fuel failure or meltdown, containment sufficient to control any incident, and instrumentation for control and safety circuits above minimum quality, are main aspects of safety criteria; some operational procedures described.

Training Plant Civil Defense Corps, A. W. Harrigan. *Safety Maintenance,* Vol. 119, No. 2 (February, 1960), p. 9-10. Western Electric's "Personnel Protection" program to train all employees in special action needed to minimize blast and radiation injuries; First Aid courses given, additional fire-fighting auxiliaries to supplement existing crews, training of rescue squads and radiological monitoring squads; alert system and shelter drills instituted; warden organization trained; manuals of training in personnel responsibilities.

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AMERICAN SOCIETY OF SAFETY ENGINEERS

Membership Information

THE American Society of Safety Engineers has established the following classifications of active membership.

ASSOCIATE MEMBER – To be eligible as Associate Member an applicant shall be at least twenty (20) years of age and

a. Shall have a degree in engineering from a college or university whose curriculum is accredited by the Engineers' Council for Professional Development or shall have legal registration as a professional engineer and, in addition, shall be engaged in safety engineering with at least one (1) year's experience, no time being credited to this one (1) year unless at least fifty (50) per cent of the time was devoted to safety engineering, or shall have supervision over the safety engineering function of his organization; or

b. Shall have a college degree other than that specified in "a" above and, in addition, shall be engaged in safety engineering with at least three (3) years' experience, no time being credited to this three (3) years unless at least fifty (50) per cent of the time each year was devoted to safety engineering; or

c. In lieu of a college degree, shall be engaged in safety engineering with at least five (5) years' experience, no time being credited to this five (5) years unless at least fifty (50) per cent of the time each year was devoted to safety engineering.

MEMBER – To be eligible as a Member an applicant shall be at least thirty (30) years of age, shall have the qualifications required for Associate Membership and also shall have (5) years' experience in addition to that required by and of a type defined in the subsection of the requirements for Associate Member which is applicable to him.

FELLOW – To be eligible as a Fellow, a Member shall be nominated upon the unsolicited recommendation of three (3) other Members, shall be at least forty (40) years of age, shall have been a Member for at least thirteen (13) years, and shall have been engaged in safety enginering for at least twenty (20) years, during at least five (5) years of which he shall have been in responsible charge of the safety engineering function of his organization. In addition, he shall have made an outstanding contribution to the safety engineering profession. Recommendations of candidates for the Fellow classification, along with substantiating data, shall be sent to the Secretary of the Society, who shall submit such recommendations and substantiating data to the Committee on Membership. The Committee on Membership shall report its findings to the Executive Committee for action. Fellows shall be elected by a majority vote of the Executive Committee.

AFFILIATE MEMBER – To be eligible as an Affiliate Member an applicant

a. Shall be at least twenty (20) years of age and shall be engaged in safety engineering with at least one (1) year's experience, no time being credited to this one (1) year unless at least fifty (50) per cent of the time was devoted to safety engineering; he may remain in this classification while qualifying for Associate Member or Member Classification; or

b. Not being engaged in safety engineering, shall be at least twenty-five (25) years of age and shall have pursuits, attainments in accident prevention, or practical experience, extending over a period of at least three (3) years, which shall qualify him to cooperate with members of the Society and to render service to the Society.

for additional information write to

The American Society of Safety Engineers
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(or contact your local chapter)

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